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COMPETENCE BASED MET AND THE ROLE OF GROUP-LEARNING METHODS

OSPOSOBLJENOST POMORACA TEMELJENA NA NAOBRAZBI I IZOBRAZBI TE ULOGA METODA GRUPNOG UČENJA

SUMMARY

Global standards of maritime education and training (MET) mandated by the International Convention on Standards of Training Certification and Watch-keeping for Seafarers while provide an excellent framework for development of competency based curriculum they clearly fall short of identifying the contents of educational inputs leading to wide diversity in the curriculum standards. Aside from such undesirable variance in the MET standards the methodology adopted for transfer of knowledge finds no mention in the internationally prescribed standards which in unison are detrimental to the desirable competence implicated in number of maritime accidents. The paper examines the suitability of group-leaning process that espouse the philosophy that the measure of competence should be based on performance rather than on the possession of knowledge and skills; on understanding rather than enhanced repertoire of knowledge; on the process of transfer of knowledge and skills moving from teacher-centred learning to student-centred learning to promote understanding with particular reference to the application of group-learning processes, that take a holistic view of all pertinent factors affecting performance.

Key words: *STCW, competence, group-learning, learning skills*

SAŽETAK

Svjetski standardi za naobrazbu i izobrazbu pomoraca koji su uvedeni po Međunarodnoj konvenciji o standardima za izobrazbu, izdavanje svjedodžbi i držanje straže pomoraca, a kojima je određen okvir za osposobljavanje pomoraca na temelju nastavnog plana i programa, ipak nisu odredili sadržaje obrazovnih programa i planova što je dovelo do velikih razlika u standardima nastavnih planova i programa. Pored takve nepoželjne različitosti u standardima naobrazbe i izobrazbe pomoraca, metodologija koja je prihvaćena za prijenos znanja ne spominje se u međunarodno propisanim standardima, što ide na uštrb one osposobljenosti koju je poželjno imati kad se pojave brojne pomorske nesreće. U radu se analizira primjerenost procesa grupnog učenja koji prihvaća filozofiju da se mjerenje osposobljenosti mora temeljiti više na rezultatu izvedbe nego na posjedovanju znanja i vještine; više na razumjevanju nego na pretjeranom programu znanja; više na procesu prijenosa znanja i vještina s koncepcije učenja s nastavnikom u središtu učenja na koncepciju učenja sa studentom u središtu učenja, promovirajući na taj način razumijevanje s osobitim osvrtom na primjenu procesa grupnog učenja, što predstavlja cjelovit pristup svim odnosnim čimbenicima koji utječu na rezultate izvedbe.

Ključne riječi: *STCW konvencija (Konvencija o standardima za izobrazbu, izdavanje svjedodžbi i držanje straže pomoraca), osposobljenost, grupno učenje, vještine učenja*

1. INTRODUCTION

It is a commonplace in the shipping industry safety parlance that all the major international safety conventions and their amendments were created in response to accidents of highly adverse consequences. Adoption and implementation of the STCW Convention too was in response to the outcomes of enquiries into ship accidents that pointed to 'human error' as the main causation factor. It is usual to come across statements that 80% of accidents are caused by human error [2, 3, 24]. Lessons learnt from the incidents and accidents do provide us with the essential knowledge for avoiding their recurrence provided of course the causes identified are actual or close to reality.

Investigations and analysis of most inquiries into mishaps that occurred in the nuclear, aviation and process industries have emphatically identified human factors as the main reason for accident causation. Such literature points to a numbers of factors at the human-machine interface leading to situations which predispose operators to commit errors. There is a greater realisation of the influence that the organizational, environmental and job factors have on safety of a socio-technical system. Deliberations on the impact of organizational and work environment factors on shipboard accidents are out of scope of this paper and are not discussed. Similarly discussions on physiological and psychological factors like fatigue and attitudes among the personal factors of seafarers are not included.

Literature is abound with statements emphasising the role of human element at different levels of management hierarchy in a socio-technical systems as substantially contributing to accidents by producing preconditions for unsafe situations at the human-machine interface. This accentuation is however based on presuppositions that the front line operators at the human-machine interface possess the requisite knowledge, understanding and skills to operate the technical systems, make appropriate decisions and take suitable actions to ameliorate unsafe situations that may develop. Competence of operators is without doubt one of the most important human factors in operational safety. Developing prospective seafarers who possess requisite competence demands an efficient transfer of specified knowledge and skills during their academic learning period and later during their professional careers. Objectives of MET are intended to engender deep learning of relevant concepts and development of psychomotor skills through implementation of physical and cognitive apprenticeship. Specifying and implementing suitable methods for assessment of competence are no less important as they have a strong bearing on the process of learning and its measurement. This paper explores collaborative learning techniques for delivery of curriculum from the stand point of their relevance, feasibility and long term impacts on the professional life of the prospective seafarers.

2. BACKGROUND

The response of the world community, through the auspices of International Maritime Organization (IMO), towards maritime catastrophes has immensely contributed to raising the standards of ship designs, constructions and equipment on board. The down ward trend in the rate of occurrence of major accidents, loss of life, property damages is a testimony to the effectiveness of such globally agreed regulatory efforts. At the same time however on an average over a hundred ships (over 100 gt) and hundreds of valuable lives are still lost annually [19]. Shipboard safety demands more than sophisticated equipment and automation. The human element has always been the foundation on which everything else is built upon and will remain so irrespective of all the technological advances.

Operational error on part of the seafarers has been identified as a prominent accident causation factor in number of maritime accidents. Erroneous or unsafe acts committed by the operators leading to failures (active failures at the man-machine interface) in a socio-technical system have been generally referred to as 'human errors' which have been summarised as the failure of planned actions to achieve their desired ends [7]. The unintentional outcome of planned actions may be due to a lapse or a slip characterised by memory failure and attention failure respectively. In contrast the mistakes are operational failures that occur as an outcome of wrong selection of a plan of actions or a procedure. These errors in planning are committed due to the lack of operator competence [23].

Analysis of investigation reports of accidents in machinery spaces, available of the websites of six national authorities, namely the Australian Transportation Safety Bureau (ATSB); Transportation Safety Board Canada (TSB); Danish Maritime Authority (DMA); Marine Accident Investigation Branch UK (MAIB) and the National Transportation Safety Board USA (NTSB), indicates that lack of generic marine engineering knowledge, applicable seamanship knowledge and specific knowledge and training concerning the involved ship's machinery and engineered systems have been responsible for 19.4% of accidents in machinery spaces. A similar study carried by Makoto Uchida analysing the court judgement reports on accident enquiries concerning machinery spaces has concluded that 20.7% of accidents are attributable to knowledge based errors [29].

Aetiological literature puts the accident causation factors into three categories the organizational factors, the work environment factors (job factors) and personal factors. Personal factors primarily relate to the front line operators [26]. They encompass the technical and social competence, physical & mental abilities and capabilities, aptitude and attitude of the operators. STCW Convention emphasises on competence as the intended outcome of MET. It specifies criteria for assessment of competence as well as a number of assessment method alternatives for each competence. For various reasons however the process of curriculum delivery at MET institutions continues to be such that engenders the behaviourist as against constructivist approach to learning, surface learning as against deep learning and producing short time learners as against lifelong learners. Specified methods of assessment in the convention also encourage such types of learning characteristics.

3. STANDARDS OF MET FOR COMPETENCE DEVELOPMENT

3.1 Standards of Technical Competence

The standards of MET have always been based on the industry requirements commensurate with contemporary technology with due cognizance to the national and international safety regulations. Rapidly changing technology for reasons of enhanced safety, reduced operational cost, higher productivity and better working conditions for operators has always created a gap between the standards of competence demanded by the technology and those set by the MET institutions. Consequently there is always a time gap in updating of curriculum to the changing operational needs. This inevitable gap is detrimental to the safety and efficiency of operations.

The competencies listed in the mandatory Code A of the STCW Convention and the standards of knowledge, understanding and proficiency while provide general guidelines for development of curriculum they very much fall short of specificity of standards. Thus the interpretations by default are left to individual institution/education authority/maritime administration in line with the national educational standards control system. Learning objectives within this frame work of competence tables are set on the basis of operational demands from the industry i.e. the types of ships, their equipment and technical systems which inevitably are generic in nature. It is impossible to cover all perceivable types and makes of machinery and equipment in the curriculum. This obviously is a recipe for undesirable variance in the standards of targeted competence of seafarers.

3.2 Standards of Social Competence

Employment pattern of seafarers have been changing overtime. Targeting cheaper workforce from the labour supplying countries leading to what is normally referred to the 'globalisation of crew' has an impact on the level of available competence as against that demanded. The process of globalisation of crew has introduced a broad social and ethnic diversity as a result of multinational crew with varying and inadequate professional standards [12]. This pattern of ship manning has accentuated the need of social skills on part of the seafarers. Resoling differences in opinions through discussions and agreements, honouring others' view points, caring for others and taking them along are crucial aspects of living in a community and especially small and isolated community on seafarers on board each ship. Developing amicable human relations, team work and leadership skills are legitimate and valuable classroom goals not just extra curricular ones [27]. This is as applicable to MET as to any oth-

er educational set up. Shipping companies while engaging seafarers aside from technical knowledge and skills also look for communication skills and psychological attitude towards team work [25].

One of the competence requirements for engineering staff at management level included in Table A-III/2 of the STCW Code, specifies knowledge of personal management, organization and training on board. Personal management is a vast subject and in the absence of specificity of learning objectives and lack of guidance the actual course contents are solely dependent on the course developer's perception of needs, his/her experience & background, personal preferences and national regulations on crew employment leading to a diversity of standards of social skills repertoire of trainees.

3.3 Standards of Curriculum Delivery

STCW Convention requires training and assessment through well structured written programmes for achieving prescribed standards of competence. This implies documented learning objectives, procedures for delivery of course material and assessments. While minimum education and training standards in the form of expected competences provide some, though limited, guidance on the standards of curriculum contents, there is no mention of the process of transfer of knowledge, enhancement of understanding or development of skills. There is of course a specific requirement in the provisions of the STCW Code that the instructors, supervisors and the assessors are appropriately qualified and it does imply that they possess the necessary skills to implement appropriate procedures to affect students' learning.

4. TECHNIQUES FOR EFFECTIVE LEARNING

4.1 Transfer of learning

The philosophy of education and training for engineers, and for that matter for seafarers, is based on the general belief that once the prospective seafarers acquire the minimum requisite knowledge and practical skills in their learning environments of class rooms, laboratories, workshops and on board, they will be able to modify them as necessary and apply them to meet the operational demands in their actual work situations. Transfer of learning is a fundamental assumption of educators and they believe that whatever knowledge and skills are transferred will be retained or remembered over some interval of time and used in appropriate situations [18]. The transfer of the learnt knowledge and skills to meet the requirements of the work situations are greatly influenced by the level of knowledge and skills repertoire, context under which they were acquired and upon the cognitive dexterity of the individuals. The suppleness of knowledge and skills transfer to work situation depends upon the ease with which learning can be retrieved which in turn is a function of how the material was learnt. Stronger the understanding and comprehension of learnt knowledge more readily the transfer can occur. Learning that occurs during onboard training, practical exercises or on job is more easily transferred than those learnt in the class room [9]. Conceptual learning that involves understanding is more likely to be transferred than the material that is merely committed to rote memorization because thinking at deeper level of abstraction facilitates transfer by fostering meta-cognition [22].

4.2 Factors affecting the learning process

Outcome of learning may be gains in knowledge, acquisition of skills, deepening of understanding and capacity to reflect; development of problem solving skills; change in perception, attitude, values and behaviour; and desire to learn more [6,8,9]. Humans have natural propensity for learning, they are curious, they are natural decision makers and problem solvers and because they have needs and goals they are motivated to learning. For any learning to take place however it is essential that the person, as a learner, is actively involved in the process of learning. In case of an adult this involvement means creating meaning out of the new information in relation with the repertoire of knowledge and concepts already existing in the person's psyche. Consequently the quality of learning is characterised by one's repertoire i.e. awareness, experience, practice and motivation that engenders the learner's active involvement [1].

Sitting in a class and listening to the lecturer is a passive form of learning. Learning in this form can be enhanced if the student gets in-

volved in making connections with other ideas and experiences, creating new concepts or modifying the existing ones thus enhancing cognitive activity. More active the student is through conjecturing and making connections between ideas more academically engaged or involved s/he becomes with learning process [13, 14]. Personal learning style of learners (concrete v/s abstract learners), complexity of material being presented, teacher's style and approach to teaching and general fluctuations in concentration level in the classroom setting influence the extent and duration of such involvement in learning. Quoting a study by Hartley and Davis it is stated by Felder that the students were found to recall about 70% of the contents presented during the first ten minutes of the lecture and 20% of the contents of the last ten minutes [11].

Extent of learning is affected by the students' own perception about the fundamentals of learning and division of tasks between them and teachers [28]. Learning is affected by the types of goals they set for their learning e.g. goals as passing examinations or achieving higher awards as against deepening understanding and acquiring skills [6, 30]. Models of assessment and their perception by the students influence students resorting to either surface or deep learning. Some students like doing what they are already comfortable with from their earlier studies and would resist divulging from that and feel uneasy when the new information is presented in a different way or change is made from passive to active learning [5].

4.3 Enhancing Learner Involvement

Techniques allied to 'student-centred' learning are more successful not only in the transfer of knowledge but also in longer retention of knowledge in comparison to the traditional teacher-centred approach to teaching/learning. Learning procedures and environments that allow the learners to talk to put forward their views, listen to other's views, reflect, justify and agree for reaching comprehension of concepts and their application to problem solving exercises are active learning methods which promote deep learning [20]. Some of the teaching techniques that keep students engaged in the process of learning are characterised as group based learning methods under the broad name 'collaborative learning'. In this kind of learning process the students are essentially required to actively involve themselves, in small groups, to seek relevant information on a particular subject matter, query or a problem. They are required to actively engage themselves to discuss, reflect, explain own understanding, and question others' conclusions to comprehend the intended concepts or look for solutions depending on the preset targets of learning. Unlike teacher-centred approach to knowledge transfer in large a class room, active involvement of students is assured as their dissociation from the learning activities is easily noticed by the peers who need contribution from each other in the learning process.

The onus of learning is on the students and they are responsible for their own learning. This engenders an intrinsic motivation in them for their active participation and own success which is linked to the success of their group. Feeling of achievement and ownership of learning process are very strong motivating factors in the process of learning and the likelihood of these is more pronounced in the collaborative learning atmosphere. Such an approach, based on the theory of constructivism, not only creates conditions for deep learning during institutional education but also helps the students in developing skills for continual learning during their professional careers, that demand skills for collaborative work, effective communication and teamwork [21].

4.3.1 Collaborative learning

Collaborative learning is an umbrella term that encompasses a variety of small group educational approaches in which students collaborate face to face, applying their intellectual efforts jointly to search for solutions, constructing meanings or creating something new with the information and ideas [27, 28]. The basic tenet of collaborative learning is in concert with 'Cooperation is better for productivity than competition or individualisation for all but rote decoding tasks' [15]. Some of the names given to this form of teaching/learning are collaborative learning, cooperative learning, collective learning, learning communities, simulation, role play, peer tutoring, peer learning, reciprocal learning, team learning, problem based learning, study circles, study groups and work groups [4, 10, 16, 18].

4.3.2 Cooperative learning

Cooperative learning is most widely used method and is applied in the primary, secondary, post secondary and tertiary education level in the USA and some parts of Europe. In comparison to the method that goes under the name of 'collaborative learning' the 'cooperative learning' format is more structured and comparatively closed ended as far as the outcomes of learning contents are concerned [4]. This format of teaching/learning distinguishes from others on the basis of following five elements [11]:

(i)Positive interdependence – team members rely on one another for success, 'float or sink together'; (ii) Individual accountability – each is accountable for his/her share of work and mastery of all the material to be learnt, 'no hichhiking'; (iii) Face-to-face promotive interaction – teaching and encouraging each other through reasoning, feedback and challenging conclusions; (iv) Appropriate use of collaborative skills – students develop and practice trust building, leadership, decision making, communications and conflict management skills; (v) Group processing – setting up of group goals, periodic assessment to identify changes necessary to function more effectively in the future

These elements foster deeper understanding of all group members irrespective of their level of existing knowledge as even strong students while explaining finding gaps in their own understanding. According to Johnson, Johnson and Smith quoting 168 comparative studies involving students above the age of 18 years, there was substantial improvement in grade scores from 50 percentile to 69 percentile when learning collaboratively [17].

To achieve agreed objectives and to raise the standard of the group as a whole all members feel obliged to contribute. Compared to the teacher-centred approach there is a lower level of anxiety and stress. Some students feel comfortable to explanations from peers as compared to the teachers. They develop more positive attitude towards subject areas and have higher self-esteem.

The students develop more positive and supportive relationship with fellow group members. Interaction amongst students helps them to know themselves as well as their peers from the standpoint of academic strengths and weaknesses. Such interactions are of particular value to seafarers who during their shipboard professional life have to deal with persons of disparate cultural backgrounds, varied educational levels and of different nationalities speaking different languages. They become aware of the lacunae in their own power of expression. Such realisation provides an impetus to the learners to garner efforts for their self improvement on this area vulnerable to conflicts.

4.4 Impediments to application collaborative techniques

Number of variations within the cooperative learning domain such as Student team-Achievement Divisions; Team-Games-Tournament; Jigsaw; Team Assisted Individualization; Learning Together; Group Investigation etc. have been used which may perhaps indicate a significant level of its use. However outside the US the implementation of such techniques at the undergraduate and graduate level is still unknown especially in the technical education, and particularly so in the field of MET.

Since its initiation over eighty five years ago this technique having gone through the assessments and valuations by researchers has acquired mixed response. One reason is perhaps its flexibility of structure generating a wide variety of applications and perhaps losing its specificity with many unable to differentiate between group learning and teaching students by seating in small group [17]. There is also scepticism about its success in view of new and untried system.

If the existing curricula or a portion of it is selected for delivery through collaborative techniques, the structure needs modification as the process is more time consuming than traditional class room lectures. This aspect itself is an impediment in view of the large volume of syllabus that the teachers are required to deliver in specified time which is always short. An efficient implementation needs planning for delivery, thus extra work on part of the teachers, though only initially, nonetheless inimical.

Assessment of learning and evaluation of the learning process is an important aspect of course delivery. In the group learning activities assessment of both the level of learning achieved and the extent of contribution of each

student is essential for awards of individual grades and grading of groups.

Group learning is characterised by active participation and contribution of individual members. Potential of their contribution heavily rests on their skills, aptitude and attitude towards group learning process. Prior development of these attributes is essential.

4.5 Application to MET

MET is characterised as technical study and as against art and humanities subjects is founded on the scientific facts and principles. Although for learning of scientific facts the principles of collaborative learning can be applied but the time and efforts required for transfer of such factual knowledge outweighs the benefits.

The incumbents to the MET are fledgling adults who during their studies at the secondary school level, in all likelihood, have been used to the rote learning and would have had no or minimal exposure to group learning activities. If collaborative learning techniques are to be implemented the students need to be suitably and gradually prepared for it during initial MET process so that collaborative learning techniques can be implemented when they have completed their foundation studies e.g. scientific theories, working principles etc. and are in the process of learning the shipboard engineered systems, their operation and management.

Although group activities are used in practical training processes these courses are more like 'small group training' in traditional ways. However some specialised training on simulators specially designed to make the students collaborate in novel situations would qualify for this type of learning and will be best suited in the later part of the academic periods.

Most important resources for the success of collaborative learning process are the teachers. MET teachers who are old maritime professionals may have limited exposure to teaching and learning processes and may believe in delivering knowledge the way they acquired it. They would need an exposure and training to develop right attitude towards implementation of collaborative learning process, training in group learning techniques including setting objectives, implementing collaborative learning procedures, providing guidance to groups, techniques of leading the process.

5. CONCLUSIONS

Competence of seafarers is responsible for nearly one fifth of the major maritime accidents. Seafarers need to acquire comprehensive understanding of technical facts through active learning processes that enhances deep understanding of scientific as well as social concepts and help develop technical, cognitive and social skills. Skills for group/team work, good communications and resolving issues are as essential because they have to work in such environment. For developing social skills the traditional teacher-centred class room lectures method is not ideal. Transfer of learning is contextual, it is easier if the learning takes place in similar environment. Learning process for seafarers does not end with the formal pre-sea MET but continues during professional careers. Group learning processes while requiring learners to involve themselves in critical thinking also develops their learning skills and make them lifelong learners, and may motivate them to continue learning through collaborative process during professional career for mutual benefits of professional colleagues. Suitable adjustments in the curriculum will be needed for implementation of group learning techniques. Success of its implementation will depend on the expertise and positive attitude and calls for specific training of the teachers in the aspects of collaborative learning process.

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